The Pennsylvania Space Grant Consortium
The Pennsylvania State University
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PROGRAM DESCRIPTION

The National Space Grant College and Fellowship Program consists of 52 state-based, university-led Space Grant Consortia in each of the 50 states plus the District of Columbia and the Commonwealth of Puerto Rico. Annually, each consortium receives funds to develop and implement student fellowships and scholarships programs; interdisciplinary space-related research infrastructure, education, and public service programs; and cooperative initiatives with industry, research laboratories, and state, local, and other governments. Space Grant operates at the intersection of NASA's interest as implemented by alignment with the Mission Directorates and the state's interests. Although it is primarily a higher education program, Space Grant programs encompass the entire length of the education pipeline, including elementary/secondary and informal education. The Pennsylvania Space Grant Consortium (PSGC) is a Designated Grant Consortium funded at a level of $845,000 for fiscal year 2010.

PROGRAM GOALS

PSGC Goals: (1) Develop and promote opportunities for students to participate in research and discovery, including student flight projects; include programs with a focus on enhancing the participation of students from underrepresented groups. (2) Provide graduate and undergraduate training in NASA-related fields through the mechanism of fellowship and scholarship awards; increase the number of awards to students from underrepresented groups. (3) Support the development of interdisciplinary courses, curricula, and workshops, including introductory courses designed for undergraduate students not majoring in scientific or technological disciplines. (4) Model diversity in space grant leadership, programs, and activities; implement programs targeted at increasing the retention rate of students from underrepresented groups in science and engineering. (5) Provide information and programs to increase access to the excitement, knowledge, and technology from America's earth, air and space programs; establish PSGC as a viable state resource and catalyst for aerospace research, education, and economic development. (6) Cultivate a statewide network of partners from universities, industry, museums, science centers, state and local agencies to pursue aerospace research, education, and economic development goals. (7) Develop earth, air, and space programs to enhance public scientific literacy and to complement community needs.

FY2010 Targets: Our target was to award 54 PSGC fellowships and scholarships. We intended to award 19 statewide scholarships to intern at NASA Centers, four Lehigh-Goddard research internships, and two Lincoln internships with mentor at Penn State. We planned to award 55 new research scholarships for first-year, female, and minority students to gain hands-on laboratory experiences with an underling objective of having >65% female and >30% minority participation. We expected to support ten students in

the Abington College Undergraduate Research Activities (ACURA) project, and ten for the National Radio Astronomy Observatory (NRAO) project at Penn State Abington. We expected to support five undergraduates at Franklin and Marshall College and/or Gettysburg College performing undergraduate research in the National Undergraduate Research Observatory (NURO) program. We aimed to have a total of 55 students participate in student space hardware programs (e.g. Student Space Programs Laboratory-SSPL). We expected to have 20-30 student participants in two NASA-supported courses offered: Flight Vehicle Design and Fabrication (FVDF) and Intelligent, Embedded, Robotics Systems. Three students are proposed to participate in a new community college research program. We aimed to support five West Chester University STEM majors in an undergraduate research program, and two HBCU students in our Lincoln University Environmental Sciences Research project. 13.8% of awards from each program are expected to be allocated to underrepresented minorities. We aimed to continue our mini-grant program by supporting five early career scientists and three higher education grants. Our goal was to have a total of 130 in-service educators participate in teacher professional development workshops (e.g. Secondary Robotics). Through our precollege programs, we expected 25 high school and >75 middle school student participants. Finally, we aimed to host four PSGC community events.

PROGRAM/PROJECT BENEFIT TO OUTCOME (1, 2, OR 3)

Outcome 1 Highlights

Examples of workforce development from FY2010: Mallory Snowden (Lehigh), a NASA/LARSS intern stated "*I graduate in May, but I already have multiple job offers with engineering firms in San Francisco, Philadelphia, and Washington D.C.*" **Emmanuel Fonseca** (PSU), John Mather Goddard intern, is currently a graduate student at the University of British Columbia in the Department of Physics and Astronomy. **Charles Wright**, **William Chang**, and **Brittany Love** (Temple) designed a vibration suppression system for flight instrumentation that flew out of the NASA Wallops Island Flight Facility. These three students recently joined the STEM workforce at Naval research facilities in Philadelphia. **John Zebley** (Temple) worked at the Goddard Space Flight Center for over a year and is now employed as full-time contractor. **Jeffrey Diebold** (Lehigh) worked on the design and fabrication of the Hopper Spacecraft Simulator and reported that "*these projects have prepared me for research at the graduate level."* He began his PhD program in Aerospace Engineering in the fall of 2010 at the University of Illinois. **Andrew Abraham** (Lehigh) also worked on the Hopper and plans to use his experience for his doctoral thesis in physics. He was recently appointed to the Lunar Lion Google X Prize team. NASA/LARSS intern, **Gianna-Rose Acosta** (PSU), and Launch Vehicle Interface Engineer, **Michael Policelli** (PSU), were also selected as members of the Lunar Lion Google X Prize competition team to develop a lunar module to land on the moon by 2015. **Aaron Diefendorf** (PSU) has recently accepted a faculty position at the University of Cincinnati, and has told us, "*without support like Space Grant, (he) would not have been offered a faculty position without years of post doc experience*." **Gregory Tudryn** (PSU), a PSGC fellow, stated that his Space Grant experience "*provided a distinct and novel direction for (his) research and thesis focus. (He) enjoyed the outreach and community service that it has encouraged members to participate in.*" **William Campbell** and **James Zwiebel** (PSU), worked with

Penn State scientists and engineers in Antarctica to develop a network of wireless interconnected geophysical sensors to measure the outcome of global warming on melting ice sheets. **Tara Fulton** (PSU), a postdoctoral mini-grant recipient, is providing vital research data on the genetic markers in polar bears to analyze the effects of climate change. These results are contributing to the National Geographic's series "Naked Science," currently under production. **Katrina Corley** (CMU) reports that through her PSGC experience she "*discovered a love of autonomous systems which led (her) to (the) graduate program*" that she began in Fall 2010 at Georgia Tech.

Outcome 2 Highlights

The professors were EXCELLENT!!! They genuinely were excited about what they do and trying to help us learn. They were constantly asking us how material could be applied in our classrooms. They listened to our ideas and sought our input. I was just blown away by their level of care and attention. They made very difficult material fun and exciting. I feel like I was personally and professionally enriched and will be able to guide very inquisitive students better in the future on these topics. - Anonymous STEM Educator, Astrophysics Workshop at Penn State

PROGRAM ACCOMPLISHMENTS

In relation to our overall goals, we are proud to report that our college programming (F/S, HE, RI) totals 564 individual participants. This includes 197 participants in ten different student flight programs, and 205 awarded fellowships, scholarships and internships to students in STEM fields. We developed six new courses and revised seven pre-existing courses. Additionally, the PSGC supported 64 underrepresented undergraduate and graduate students.

In terms of our specific targets for our **Fellowship and Scholarship** programs, we exceeded our goal and awarded 56 PSGC Fellowships and Scholarships with 16% being awarded to underrepresented minorities. We surpassed our internship target with 20 students funded at NASA Centers and an additional eight Lehigh students for the Lehigh-Goddard internship program. However, only 7% of the funded students to NASA Centers were underrepresented minorities. We exceeded our targets with 69 new WISER/MURE/FURP scholars and 53 returning scholars (84% female and 16% minority). In terms of our specific targets for our **Higher Education** programs, we exceeded our target with 60 students in the ACURA program (with 30% from underrepresented minority populations). We surpassed our target with 15 students in the NRAO project, 60% of which were underrepresented minorities, far exceeding our target of 13.8%. At Franklin and Marshall and Gettysburg colleges, NURO exceeded its targets with six students involved in undergraduate research. Our student space hardware programs greatly exceeded their targets with a total of 128 participants. However, only 11% of these students were women, significantly missing our target of 20%. These results underscore the challenges of promoting hands-on engineering experiences to female students when programs grow quickly in size, and suggest that PSGC needs to continue to focus on this issue. Our FVDF project exceeded both of its targets with 28 participants and 21% women. The new Temple University Robotics Systems course fell short on targets, having 13 total participants, 15% of which were women. Lastly, our higher education mini-grant program exceeded its target with four funded projects.

In terms of our specific targets for our **Research Infrastructure** programs, our mini-grant program met its target with five junior faculty supported. We exceeded our targets for our West Chester program with eight STEM students involved in undergraduate research. Our Lincoln University Environmental Sciences project met its target of two student participants, both of which were underrepresented minorities.

Precollege programming supported a total of 236 in-service educators. With regards to our specific targets, we exceeded our objectives for Secondary Robotics, Science Workshops for Educators, and National AeroSpace Training and Research (NASTAR) workshops with a 167 in-service teachers. Over 28% of these teachers served classrooms with >50% minority populations and 80% of teachers reported using the course content after one year. The GLOBE workshops did not meet the target with 24 participating educators. Saturday Science program exceeded its targets with 18 meetings, 57 K-12 student participants, 58 parents involved, and 54 pre-service teacher participants. The Introduction to Electrical Engineering Course also exceeded its target with 27 participants, seven of whom were underrepresented minorities. Finally, we approached our target by hosting four PSGC Community events with more than 3,000 total participants.

We have focused on **NASA Education Current Areas of Emphasis** by supporting 10 hands-on engineering programs at five different institutions across the commonwealth. We provided teacher professional development opportunities for over 200 STEM educators incorporating best practices in teaching and providing hands-on activities for middle school students using NASA materials. We provided summer internships for minority students to participate in research experiences at different college campuses. We have reached out to community colleges in Pennsylvania and will continue to work on possible collaborations. We continue to fund aeronautics research through our mini-grant program. In FY2010, we hosted two workshops on global climate change and wind energy for in-service educators and have funded a research project on the effects of global warming on ice sheets and sea level rise. We are constantly aware of the need to reach out to diverse participants and have strengthened our ties with the two HBCUs in our consortium.

PROGRAM CONTRIBUTIONS TO PART MEASURES

- **Longitudinal Tracking:** Student Data and Longitudinal Tracking: Total number of direct participants = 564; Fellowship/Scholarship = 205, Higher Education/Research Infrastructure = 359; 30 of the total awards represent underrepresented minority F/S funding. During the FY2010 program year eight are pursuing advanced degrees in STEM disciplines, four accepted STEM positions at NASA contractors, 11 accepted STEM positions in industry, 15 accepted STEM positions in academia, and five went on to positions in non-STEM disciplines.
- **Course Development:** Six new courses were created and seven courses were revised at various colleges and universities in the PSGC. Two of the new courses and one of the revised courses are two-credit graduate level teacher professional development workshops at Penn State. The remaining courses are from various STEM fields.
- **Matching Funds:** Our budget included $610,000 of matching funds for the past year.
- **Minority-Serving Institutions:** Cheyney University of Pennsylvania is the oldest of the Historically Black Colleges and Universities in America. In FY2010, we did not

support summer STEM internships at Cheyney due to the lack of quality applicants, but we plan to support two students in FY2011. Lincoln University, another HBCU, is nationally recognized for producing African Americans with undergraduate degrees in the physical sciences, computer sciences, biological and life sciences. PSGC funding focuses on supporting student research in environmental sciences as well as providing scholarships and internships for underrepresented students.

IMPROVEMENTS MADE IN THE PAST YEAR

PSGC meets twice per year with our Affiliate Management Advisory Board. We continue our successful statewide mini-grant program and supported ten projects at five different educational institutions. The mini-grant program has helped us to identify new affiliates. In FY2010, with the Board's approval, we recently added two affiliates, Drexel University and NASTAR. We have increased the number of higher education students supported by evaluating and redesigning existing programming. We decreased the use of NASA funds in supporting precollege programming, while maintaining the number of projects completed through the support of our most effective projects. We have retired outdated programs, including GLOBE workshops at Clarion University, and focused our efforts on NASA priorities.

PROGRAM PARTNERS AND ROLE OF PARTNERS IN PROJECTS

Higher Education Institutions Receiving Funding (4-year): *Lead Institution:* The Pennsylvania State University; *Affiliate Institutions:* California University of Pennsylvania, Carnegie Mellon University, Cheyney University (HBCU), Clarion University (Inactive), Drexel University, Franklin & Marshall College, Gettysburg College, Lehigh University, Lincoln University (HBCU), The Pennsylvania State University-Abington, Susquehanna University, Temple University, University of Pittsburgh, University of Pittsburgh ERC, West Chester University; *Mini-Grant Recipients:* East Stroudsburg University, Gannon University, The Pennsylvania State University-Applied Research Lab, University of Kansas

Government Institutions (Federal, State, Local): *Teacher Professional Development Workshop Partners:* Aerospace Education Services Project, NASA Astrobiology Institute, NASA Goddard Space Flight Center, NASA Swift Mission, National Science Foundation

Industry: *Affiliate:* NASTAR Center; *WISER Funding Source:* Boeing Corporation

Other Non-Profit Organizations: *STEM Education Network Members:* Academic Space Alliance (Bald Eagle, Bellefonte, Penns Valley School Districts), Center for Science and the Schools, Centre County 4-H, Centre Region YMCA, Challenger Learning Center, Girl Scouts of Eastern Pennsylvania, Hatsboro-Horsham School District, National Alliance of State Science and Math Coalitions, National Society of Black Engineers, Solar System Ambassadors, Solar System Educators, Pennsylvania STEM Initiative, Philadelphia School District

Other Organizations: *STEM Public Outreach Partners:* The Carnegie Science Center, The DaVinci Center, The Discovery Center of Central Pennsylvania, Juniata College, Public Broadcasting in Central Pennsylvania, The Franklin Institute, The Whitaker Center